

Claims

1. A process of producing transgenic plants or plant cells stably transformed on a chromosome with a DNA sequence of interest and capable of expressing a function of interest from said DNA sequence of interest, said process comprising
 - (a) providing plant cells or plants with at least two different vectors, whereby
 - (i) said at least two different vectors are adapted to recombine with each other by site-specific recombination in said plant cells for producing a non-replicating recombination product containing said DNA sequence of interest,
 - (ii) said at least two different vectors are adapted for integrating said DNA sequence of interest into said chromosome,
 - (iii) said DNA sequence of interest contains sequence portions from at least two of said at least two different vectors, said sequence portions being necessary for expressing said function of interest from said DNA sequence of interest; and
 - (b) selecting plants or plant cells expressing said function of interest.
2. The process of claim 1, wherein said at least two vectors are provided to said plant cells by Agrobacterium-mediated delivery.
3. The process of claim 2, wherein each of said at least two different vectors is provided by a different Agrobacterium cell or strain.
4. The process of one of claims 1 to 3, wherein one or all of said at least two different vectors contain(s) a functional cytokinin autonomy gene whereas said DNA sequence of interest is devoid of a functional cytokinin autonomy gene.
5. The process of claim 1, wherein said at least two vectors are provided to said plant cells by direct nucleic acid transfer.

6. The process of one of claims 1 to 5, wherein step (a) comprises providing a site-specific recombinase specific for recombination sites on said at least two different vectors.
7. The process of claim 6, wherein said site-specific recombinase is provided by including an expressible sequence coding for said recombinase on a vector of said at least two different vectors.
8. The process of claim 7, wherein expressibility of said sequence coding for said recombinase is destroyed by said site-specific recombination.
9. The process of one of claims 1 to 8, wherein said chromosome is selected from the following group: a nuclear chromosome, a plastid chromosome, or a mitochondrial chromosome.
10. The process of one of claims claim 1 to 9, wherein said at least two different vectors are adapted such that said DNA sequence of interest has T-DNA border sequences that facilitate integration of said DNA sequence of interest into said chromosome.
11. The process of one of claims 1 to 9, wherein said at least two different vectors are adapted such that said DNA sequence of interest contains homology sequences that facilitate integration of said DNA sequence of interest into said chromosome by homologous recombination.
12. The process of one of claims 1 to 9, wherein said at least two different vectors are adapted for introducing said DNA sequence of interest into said chromosome by site-specific integration.
13. The process of one of claims 1 to 12, wherein step (b) comprises screening for plants or plant cells having said DNA sequence of interest integrated in said chromosome.
14. The process of one of claims 1 to 13, wherein step (b) comprises screening for cells or plants in which said site-specific recombination between said at least two vectors has occurred.

15. The process of one of claims claim 1 to 14, wherein said at least two different vectors are adapted such that said DNA sequence of interest contains a selectable marker gene or a sequence that allows in step (b) screening for transformed plants or plant cells containing said DNA sequence of interest.
16. The process of one of claims 1 to 15, wherein a sequence portion of one of said at least two different vectors contains a selectable marker under translational control of an internal ribosome entry site (IRES) element.
17. The process of claim 16, wherein said selectable marker cannot be transcribed in said plant cells from one of said at least two different vectors but is placed by said site-specific recombination under the control of genetic elements allowing transcription of said selectable marker.
18. The process of one of claims 1 to 17, wherein step (b) comprises screening for the absence of said at least two different vectors and/or recombination products thereof with the exception of recombination products containing said DNA sequence of interest.
19. The process of claim 18, wherein
 - (a) at least one of said at least two different vectors or
 - (b) recombination products of said site-specific recombination that do not contain said DNA sequence of interestcontain a counter-selectable marker gene or another sequence that allows screening against transformed cells containing said vectors as defined in (a) or said recombination products as defined in (b).
20. The process of claim 19, wherein said counter-selectable marker gene or said another sequence that allows screening against transformed cells containing said vectors is under translational control of an internal ribosome entry site (IRES) element.
21. The process of one of claims 1 to 20, wherein said expression of said function of interest from said DNA sequence of interest comprises intron-mediated cis-splicing.

22. The process of claim 21, wherein
- a first vector of said at least two different vectors contains a first sequence portion that contains:
 - a first part of a sequence coding for the function to be expressed and, downstream thereof, a 5' part of an intron, and
 - a second vector of said at least two different vectors contains a second sequence portion that contains:
 - a second part of a sequence coding for a function to be expressed and, upstream thereof, a 3' part of an intron.
23. The process of one of claims 1 to 22, wherein three or more different vectors are provided to said plant or plant cells in step (a) and two or more different transgenic plants or plant cells are produced, said different transgenic plants or plant cells having different DNA sequences of interest integrated in a chromosome.
24. The process of one of claims 1 to 22, wherein said plant cells are provided with two different vectors and said DNA sequence of interest contains a sequence portion of each of these two vectors.
25. The process of one of claims 1 to 23, comprising the following steps (A) and (B):
- (A) providing plants or plant cells with a mixture of
- (i) a set of m primary vectors each having a primary sequence portion selected from the set (a_1, a_2, \dots, a_m) and
 - (ii) a set of n secondary vectors each having a secondary sequence portion selected from the set (b_1, b_2, \dots, b_n) ,
- whereby
- m and n are independent of each other and both are integers of >1 ,
said primary vectors and said secondary vectors are adapted such that each member of said set of primary vectors can recombine with every member of said set of n secondary vectors by site-specific recombination for producing recombination products containing different DNA sequences of interest,

each DNA sequence of interest comprises a member of said set of primary sequence portions and a member of said set of secondary sequence portions, both said sequence portion members are necessary for expressing said function of interest from said DNA sequence of interest,

said primary vectors and said secondary vectors are adapted to integrate said DNA sequences of interest into a chromosome,

- (B) selecting transformed plants or plants cells expressing a function of interest from a DNA sequence of interest.

26. The process of one of claims 1 to 23 or 25, comprising the following steps (A) and (B):

- (A) providing plants or plant cells with a mixture of
- (i) a primary vector having a primary sequence portion a_1 and
 - (ii) a set of n secondary vectors each having a secondary sequence portion selected from the set (b_1, b_2, \dots, b_n) ,

whereby

n is an integer of >1 ,

said primary sequence portion a_1 is necessary for expressing the function of a secondary sequence portion (b_1, b_2, \dots, b_n) ,

said primary vector and said secondary vectors are adapted such that said primary vector can recombine with every member of said set of n secondary vectors by site-specific recombination for producing recombination products containing different DNA sequences of interest of the type $(a_1b_1, a_1b_2, \dots, a_1b_n)$ or the type $(b_1a_1, b_2a_1, \dots, b_na_1)$,

said primary vector and said secondary vectors are adapted to integrate said DNA sequences of type $(a_1b_1, a_1b_2, \dots, a_1b_n)$ or type $(b_1a_1, b_2a_1, \dots, b_na_1)$ into a chromosome,

- (B) selecting transformed plants or plants cells expressing a function of interest from a DNA sequence of interest.

27. The process of claim 25 or 26, further comprising determining a phenotypic feature of a transformed plant or plant cell selected in step (B) due to a function of a primary sequence portion and/or a secondary sequence portion and/or

a combination of a primary sequence portion and a secondary sequence portion.

28. Transgenic plants or parts thereof like seeds produced or producible by the process of one of claims 1 to 27.
29. The transgenic plants or parts thereof according to claim 28, wherein all coding sequences and/or expressible sequences of said sequence of interest are of plant origin.
30. Use of a transgenic plant or plant cells according to claim 28 or 29 for generating a second transgenic plant or plant cells having an extrachromosomal DNA, whereby said generating comprises: inducing formation of said extrachromosomal DNA from said DNA sequence of interest integrated in the transgenic plant or plants cells of claim 28 or 29.
31. Use according to claim 30, whereby said inducing comprises providing a factor to said transgenic plant or plant cells, whereby said factor can trigger the formation of said extrachromosomal DNA from said DNA sequence of interest.
32. Use according to claim 31, whereby said providing of said factor comprises crossing of said plant or plant cells with a plant or plant cells having encoded said factor in its genome.
33. Library of plants or of plant seeds obtained or obtainable according to one of claims 25 to 27.